

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (currently amended): A semiconductor device comprising:

a first Cu interconnection including additive metal atoms and additive silicon atoms,

wherein a density of said additive metal atoms is higher in vicinities of bottom and side surfaces of said first Cu interconnection than in a vicinity of a top surface thereof,

wherein a density of said additive silicon atoms is higher in said vicinity of said top surface than in said vicinities of said bottom and side surfaces, ~~and~~

wherein said density of said additive silicon atoms ranges between 0.01 atomic % and 8 atomic % of total atoms in said first Cu interconnection, and

wherein said additive silicon atoms are diffused by irradiating said first Cu interconnection with a silane-containing gas, such that a silicide reaction of Cu does not occur.

2. (original): The semiconductor device according to claim 1, wherein said additive metal atoms include atoms of one or more of metals selected from the group consisting of Al, Sn, Ti, Si, In, Ag, Zr, Ni, Mg, Be, Pd, Co, B, Zn, Ca, Au and Ga.

3. (original): The semiconductor device according to claim 1, further comprising a second Cu interconnection overlying said first Cu interconnection and including additive metal

atoms and additive silicon atoms, wherein a density of said additive metal atoms in said second Cu interconnection is higher in vicinities of bottom and said surfaces of said first Cu interconnection than in a vicinity of a top surface thereof, and a density of said additive silicon atoms in said second Cu interconnection is higher in said vicinity of said top surface than in said vicinities of said bottom and side surfaces.

4. (original): The semiconductor device according to claim 3, wherein said additive metal atoms in said second Cu interconnection include atoms of one or more of metals selected from the group consisting of Al, Sn, Ti, Si, In, Ag, Zr, Ni, Mg, Be, Pd, Co, B, Zn, Ca, Au and Ga.

5. (original): The semiconductor device according to claim 3, wherein said second Cu interconnection includes a Cu interconnection line and a via plug extending from said Cu interconnection line and connected to said first Cu interconnection.

6. (original) The semiconductor device according to claim 3, wherein said first Cu interconnection and said second Cu interconnection are connected together via a Cu plug covered with a barrier metal film.

7. (withdrawn) A method for manufacturing a semiconductor device comprising the steps of:

forming a Cu film on top of a seed film including Cu and an additive metal;
diffusing said additive metal in said seed film into said Cu film; and
diffusing silicon atoms into said Cu film through a top surface thereof.

8. (withdrawn) The method according to claim 7, wherein said silicon atoms
diffusing step comprises the step of irradiating silane onto said Cu film.

9. (withdrawn) The method according to claim 8, wherein said irradiating step is
performed after said Cu film is configured as Cu interconnections.

10. (withdrawn) The method according to claim 7, wherein said seed film
comprises said additive metal at 0.1 to 1.5wt%.

11. (withdrawn) The method according to claim 7, wherein said seed film
comprises Al as said additive metal at a weight percent lower than 1% and not lower than 0.1%.

12. (previously presented): The semiconductor device according to claim 1, wherein said
density of said silicon atoms at said vicinity of said top surface is 8 atomic % of said total atoms
in said first Cu interconnection.

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13. (previously presented) The semiconductor device according to claim 1, wherein said density of said silicon atoms at said vicinity of said bottom surface is 0.01 atomic % of said total atoms in said first Cu interconnection.

14. (new) The semiconductor device according to claim 1, wherein an oxide layer is removed from said surface of said first Cu interconnection before diffusing said additive silicon atoms, and irradiation of said first Cu interconnection with said silane-containing gas is performed without exposing said first Cu interconnection to atmospheric air.

15. (new) The semiconductor device according to claim 1, wherein said silane-containing gas includes silane and nitrogen.

16. (new) The semiconductor device according to claim 1, wherein said irradiation of said first Cu interconnection with said silane-containing gas is performed while heating a wafer of said semiconductor device.